

REMARKS

The rejection of Claims 8-12 and 14-17 under 35 U.S.C. § 103(a) as unpatentable over US 5,348,702 (Masahashi et al), is respectfully traversed.

An embodiment of the present invention, as recited in Claim 8, is a production method of a TiAl based alloy comprising:

a step for holding a TiAl based alloy material having a fine lamellar microstructure and containing Al at least in an amount of from 43 to 48 atomic % in an equilibrium temperature range of an α phase;

a step for taking the TiAl based alloy material out of a furnace; and

a step for subjecting the TiAl based alloy material which had been held at that temperature to high-speed plastic working, while cooling the material to a predetermined working terminal temperature at a cooling speed of 50 to 700°C/min.

Another embodiment of the present invention, as recited in Claim 14, is a production method of a TiAl based alloy comprising:

a step for holding a TiAl based alloy material having a fine lamellar microstructure and containing Al at least in an amount of from 38 to 44 atomic % in an equilibrium temperature range of a ($\alpha + \beta$) phase;

a step for taking the TiAl based alloy material out of a furnace; and

a step for subjecting the TiAl based alloy material which had been held at that temperature to high-speed plastic working, while cooling the material to a predetermined working terminal temperature at a cooling speed of 50 to 700°C/min.

In response to Applicants' argument that although Masahashi et al discloses a cooling rate greater than or equal to 10K/min, Masahashi et al also discloses that the cooling rate is not significant (column 6, lines 53-55; emphasis added); that no example in Masahashi et al has a cooling speed greater than 10K/min; and that since cooling speed is not significant,

there is no motivation to increase the cooling speed beyond 10K/min, as such would necessarily involve greater cost with no concomitant benefit, the Examiner simply finds that a cooling rate greater than or equal to 10K/min meets the presently-recited cooling speed of 50 to 700°C/min, and that Applicants have not shown unexpected results for their cooling speed range.

In reply, the difference between the present invention and that disclosed by Masahashi et al is more than simply a difference in cooling speed, as now discussed.

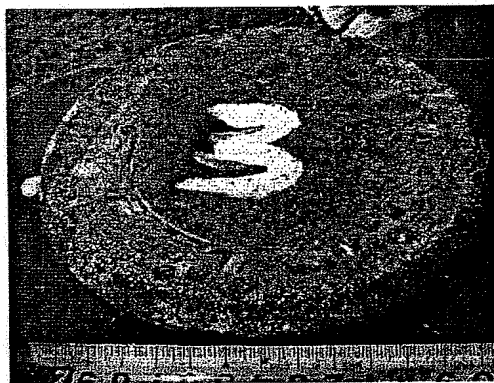
The present invention relates to a process for manufacturing TiAl alloy by hot-working, i.e., high-speed plastic working, while Masahashi et al is related to a process for manufacturing super plastic materials by isothermal-forging. In hot-working, material is taken out of a furnace after heating and is made plastic at a high distortion speed with a hydraulic press etc. outside of the furnace while being cooled. This process is highly productive and practical. In contrast to this, with isothermal forging, material is made plastic at a low distortion speed with a processing machine having heating and heat retention functions while being heated. Although this process enables the plasticity processing of materials which are hard to process, productivity is low.

The Examiner finds that removing material from the homogenizing furnace of Masahashi et al prior to hot working would have been obvious. However, the difference between the present invention and Masahashi et al lies in whether or not heating of material during plasticity processing is performed and the processing speed, a difference not apparently recognized by the Examiner.

Masahashi et al discloses the use of dynamic recrystallization at distortion speeds, i.e., strain rates, of 5×10^{-5} /sec to 0.5/sec in processing (column 6, line 23ff). In the Examples, material is processed at a low distortion speed of 10^{-4} /sec, and the temperature is controlled with a heating and heat retention device during processing. This method is low in

productivity (as the processing requires several hours) and is not suitable for industrial application.

On the other hand, the present invention does not limit the distortion speed and allows processing at high speeds. The figure below shows processing at a high distortion speed of 3.1/sec. In this example, cylindrical material 60mm thick and 80mm in diameter was hot-forged (free-forged without heating and heat retention equipment) to produce a disk having a thickness of 20mm and a diameter of 140mm. The rolling speed of the press was 190mm/sec. This high-speed plasticity processing reduces processing time (usually to less than one second) and increases productivity, providing high industrial utility.



Masahashi et al does not allow high-speed hot forging of the type discussed above as the materials used, by their nature, cannot be transformed at high speeds and would be cracked. Furthermore, when the materials are taken out of the furnace for forging with a forging machine having no heating and heat retention functionality, the temperature around the area of the materials which contacts a mold will drop sharply as soon as the materials are placed on the mold, but their capability to transform is not high even at low temperatures. This is an unanticipated effect of the present invention, which cannot be achieved by Masahashi et al.

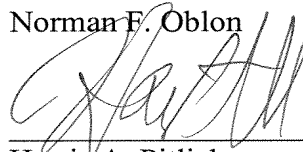
For all the above reasons, it is respectfully requested that this rejection be withdrawn.

All of the presently-pending claims in this application are believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Norman F. Oblon



Harris A. Pitlick

Registration No. 38,779

Customer Number

22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 03/06)

NFO:HAP